

Smart Street Lighting: Campus Pilot

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Abstract

To benefit city and university goals, the team created this proposal for a smart street lighting pilot on campus. Benchmarking analysis allowed for the selection of the most appropriate smart street lighting components for the university: computer vision, dimming, and air quality monitoring. Cost and funding research, as well as a survey of the OSU community, provided an idea of the project's feasibility. Analysis of crime and traffic patterns on campus allowed for the selection of the location that would best fit the pilot.

Examples of Proposed Technologies

Computer Vision Technologies



Figure 1. Image Example—Woodruff Ave.

- Reduced the response time of emergency vehicles/dispatchers and incident detection by 14 minutes.
- Denver metro area commuters experienced an average of 49 hours of delay and wasted 24 gallons of fuel in 2014 due to congestion.²
 - After initial deployment in 2015, the area saw significant improvements in traffic flow and a reduction in salary cost by 33% due to non-employee necessary monitoring.³

Dimming Capabilities

- Energy savings from adaptive lighting and dimming between 35 and 40 percent⁴
- England and Wales – half of participants did not notice part-night lighting⁵

Adaptive LED + Network		
Total Retrofit* Cost per Fixture	Energy Savings	Total Savings (\$)
\$645	91%	\$110.67

Table 1. Echelon Sample Dimming Costs and Benefits⁶

Prototype Generated Dimming Cost Saving Estimations			
	80 Watt LED w/o Variance and Motion-Detected Dimming	80 Watt LED w/ Variance and Motion-Detected Dimming (Default 100%)	80 Watt LED w/ Variance and Motion-Detected Dimming (Default +25%)
Annual Cost (2500 Streetlights)	\$65,565.00	\$48,345.08	\$46,369.03
Cost Reduction (%)	N/A (baseline)	26.26%	29.28%

Table 2. Prototype Generated Dimming Cost Saving Estimations

Air Quality Monitoring

- Chester, UK—created an integrated system of air quality sensors that link to the city's traffic management control system to help alleviate “hotspots” of pollution caused by heavy traffic.⁷
 - 29,000 deaths, with 5,000-6,000 from transportation pollution.
 - Total monetized life lost due to air pollution in the UK estimated at \$6.51 billion (0.4% of the GDP of the UK).⁸
- This “hotspot” notion has been observed from our prototype data collection with ppm spikes around “rush hour”

City Receptivity

- The Columbus Green Community Plan
 - Reduce vehicle-pedestrian incidents by 25% over the next 5 years
- Linden stakeholder meeting
 - Highest priority for the citizens is safety and overall wellbeing, without compromising privacy

Campus Receptivity Survey Results

The team surveyed a sample of 100 students and faculty members at the Ohio State University. Participants ranked six topics (see Table 3) and indicated their level of agreement/disagreement with a series of seven statements (see Figure 2. example).

Survey Results—Rankings of Importance	
Topic	Average Ranking (1-10)
Public Safety	8.82
Energy Efficiency	6.07
Pedestrian Safety	7.57
Air Quality	6.57
Parking Availability	8.23
Traffic Congestion	8.07

Table 3. OSU survey topic rankings.

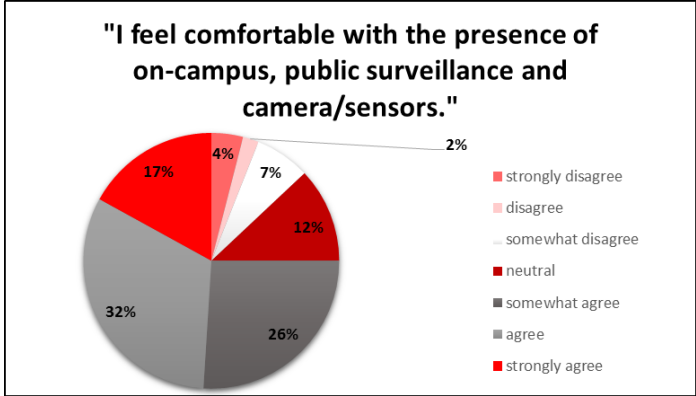


Figure 2. “Surveillance/ cameras can reduce campus crime.”

Proposed Location

- On campus -North and South campus suffer the most public safety incidents (Table 4).⁹
- A student heat map (Figure 3) indicated the areas of highest student congestion on campus is located at Schoenbaum Hall, Hitchcock Hall, and along W. 19th Avenue.¹⁰
- Traffic information given by Ohio State's proved that the most congestion—both pedestrian and vehicular—occurred on W. Woodruff Avenue between Tuttle Park Place and College Road.¹¹

Public Safety Notices and Location		
Region	# of Notices	Percent
Off-Campus	80	58.82%
South Campus	22	16.18%
North Campus	16	11.76%

Table 4. Data from Public Safety campus alerts⁹

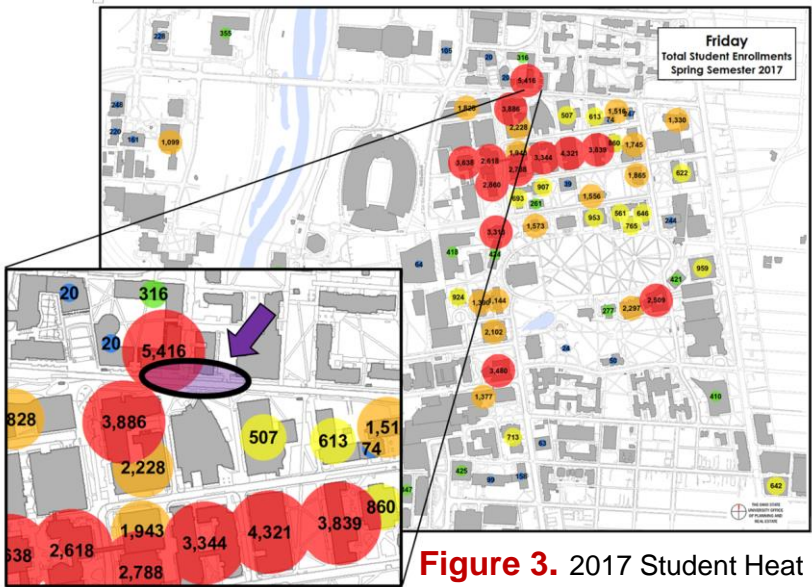


Figure 3. 2017 Student Heat Map¹⁰

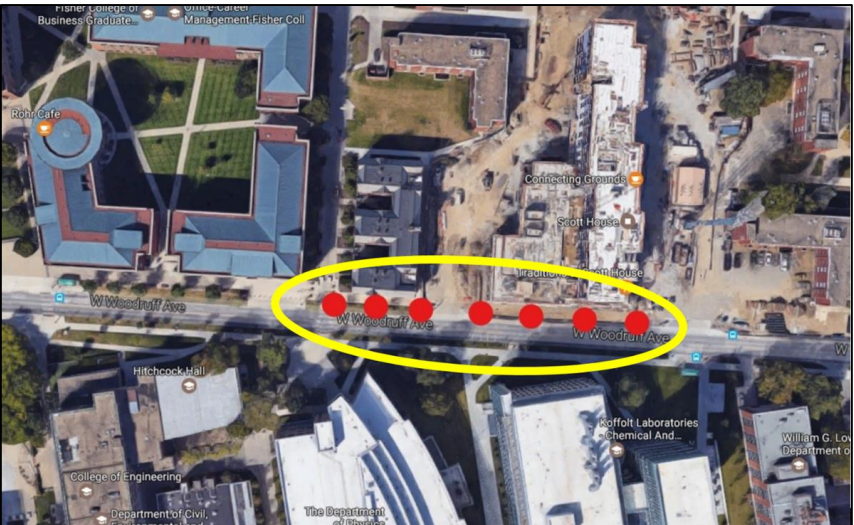


Figure 4. Proposed location of campus pilot based on data¹²

Pilot Cost Estimate

Cost/pricing estimates were requested from following companies:

- AirBeam
- Echelon
- Flashnet
- General Electric (GE)
- TrafficVision

Estimate Pilot Cost: **\$3150**^{6,13,14}

Potential Funding Options

- The President and Provost's Council on Sustainability (PPCS) funding (as “gap filler”)
- Energy, Environment and Sustainability Student Funding,
- Coca-Cola Sustainability Fund
- USDOT Smart City Challenge funding
- Donations of software/technology from potential companies

Recommendations

- 4 smart street lights on indicated section of West Woodruff Avenue
- Computer vision and air quality tech/ hardware installed on 1 of the 4 poles with all 4 lights installed with dimming modules.

The university will be able to use cutting edge technologies to improve public safety and traffic, experience cost savings through energy savings and reduction in employee-necessary monitoring, and real-time data collection for aid in policy and decision-making. Through the university's deployment, the City of Columbus will be able to learn from the successes of this pilot and utilize this knowledge in its own deployment of smart street lighting.

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